

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

1-38. (cancelled)

39. (currently amended) A substantially sulfur-free process for the production of a chemical pulp from lignocellulosic material and the recovery of chemicals used in said process comprising the steps of:

a) providing a feed stream of comminuted lignocellulosic material,

b) subjecting said feed stream of comminuted lignocellulosic material to a pretreatment,

c) reacting the pretreated lignocellulosic material from step b) with oxygen or oxygen-containing gas, in the presence of an alkaline buffer solution comprising at least one sodium or potassium compound in order to obtain a stream of at least partially delignified lignocellulosic material,

d) further treating said at least partially delignified material from step c) to obtain a chemical pulp product,

e) extracting spent liquor comprising dissolved lignin components and spent chemical substances from step b) or both steps b) and c),

f) ~~recovery of~~ recovering chemical substances from the spent liquor obtained in step e) and ~~preparation of~~ preparing fresh alkaline buffer solution to be charged to step c) or both steps c) and b),

wherein in step b) said comminuted lignocellulosic material is subjected to a mild prehydrolysis in an aqueous solution and thereafter precooked in the presence of an alkaline buffer solution, and

in step b) an aromatic organic compound is added to promote selective delignification, and

in step f) the recovery of chemical substances from the spent liquor obtained in step e) comprises,

f<sub>1</sub>) treating at least part of said spent liquor to form a concentrated stream of cellulose spent liquor,

f<sub>2</sub>) reacting said concentrated cellulose spent liquor stream with an oxygen containing gas at elevated temperature in a gas generator to form a hot gas comprising carbon dioxide and molten droplets of sodium or potassium compounds or an aerosol of sodium or potassium compounds,

f<sub>3</sub>) dissolving said sodium or potassium compounds in water to form an alkaline buffer solution and

f<sub>4</sub>) recycling and charging at least a portion of said alkaline buffer solution to step c) or both steps c) and b).

40. (previously presented) A process according to claim 39, wherein at least one agent active in enhancing selective delignification is added to the oxygen delignification step c), and wherein at least a part of said agent or its precursor is formed or recovered from step f) and recycled to step c).

41. (currently amended) A process according to claim 39, wherein said mild prehydrolysis in step b) is being effected by the addition of steam to a vessel comprising the lignocellulosic material, or by steam addition to an aqueous slurry of the lignocellulosic material.

42. (currently amended) A process according to claim 41, wherein the temperature during said mild prehydrolysis is maintained between 50 - 150°C under a time period of about 5 to 140 minutes, ~~preferably between 50 and 120°C under 20 to 80 min.~~

43. (previously presented) A process according to claim 42, wherein a filtrate recycled from a bleach plant is added to the mild prehydrolysis stage in step b).

44. (previously presented) A process according to claim 39 wherein precooking of the lignocellulosic material in step b) is performed in a temperature range from about 110°C to about 200°C for a period of about 3 minutes to about 6 hours in order to obtain an at least partly delignified lignocellulosic material.

45. (currently amended) Process according to claim 44, wherein the alkaline buffer solution primarily is made up of at least one of alkali metal hydroxides ~~[[and]]~~, alkali metal carbonates, alkali metal borates ~~[[or]]~~ and alkali metal phosphates.

46. (currently amended) Process according to claim 40, wherein said agent is a carbohydrate protector, ~~such protector being composed of~~ comprising at least one of magnesium and silicon compounds, hydrazines, boron hydride of alkaline metals and iodine compounds.

47. (currently amended) Process according to claim 39, wherein an aromatic organic compound added in step b) is a delignification catalyst ~~preferably~~ comprising anthraquinone or a derivative of anthraquinone.

48. (currently amended) Process according to claim 39, wherein an aromatic organic compound is added ~~is added~~ to the mild prehydrolysis stage in step b) ~~[[such]]~~, said aromatic compound ~~preferably~~ being selected from 2-naphthol, ~~or a xylenol~~ anthraquinone or a derivative of anthraquinone.

49. (currently amended) Process according to claim 39, wherein the comminuted lignocellulosic material is treated in step b) with an active oxygen compound ~~such as~~ selected from the group consisting of chlorine dioxide, ozone, oxygen, hydrogen peroxide ~~[[or]]~~ and a peroxyacid in order to oxidize at least a

portion of the lignin before the material is treated with oxygen in step c).

50. (currently amended) Process according to claim 39, wherein lignocellulosic material is subjected to mechanical defiberization before step c), said mechanical defiberization being effected by an energy input ranging from about 50 to about 500 kWh/ton of dry cellulosic material ~~and more preferably in the range of 50 to 300 kWh/ton.~~

51. (currently amended) Process according to claim 39, wherein oxygen delignification is performed in the presence of an alkaline buffer largely made up of alkali carbonate or alkali borate, and wherein such buffer originates in the chemicals recovery system and is transferred and used in said oxygen delignification without having been subjected to causticizing.

52. (previously presented) Process according to claim 51, wherein oxygen delignification is performed in the presence of at least one chemical reagent, said reagent being selected from one or more of a carbohydrate protector, a transition metal catalyst with a central atom selected from copper, manganese, iron, cobalt or ruthenium.

53. (currently amended) Process according to claim 52, wherein a transition metal catalyst ~~is coordinated~~ forms a complex with a ligand comprising nitrogen.

54. (currently amended) Process according to claim 53, wherein said transition metal catalyst ~~is coordinated by~~ forms a complex with ammonia, triethanolamine, phenanthroline, bipyridyl, pyridine, triethylenetetraamine, diethylenetriamine, acetylacetone, ethylenediamine, cyanide and oxyquinolines.

55. (currently amended) Process according to claim 53, wherein a transition metal catalyst is present during oxygen delignification in a concentration ranging from about 10 ppm to about 5000 ppm, ~~preferably from about 10 to 300 ppm~~ calculated on basis of dry lignocellulosic material.

56. (currently amended) Process according to claim 39, wherein oxygen delignification is performed in the presence of a carbohydrate protector ~~composed of~~ comprising an organic radical scavenger, a magnesium or ~~[[a]]~~ an iodine compound or combinations thereof.

57. (previously presented) Process according to claim 56, wherein the magnesium compound is selected from magnesium compounds soluble in alkaline solutions.

58. (currently amended) Process according to claim 56, wherein an iodine compound is present in a concentration corresponding to 1 to 15%, ~~more preferably from 3-8%~~ calculated on the lignocellulosic material.

59. (previously presented) Process according to claim 56, wherein an organic radical scavenger is an alcohol, amine or a ketone or combinations thereof.

60. (currently amended) Process according to claim 59, wherein amines, ~~alcohols and ketones are selected from amines such as~~ comprise ethanolamines and ethylenediamine, [[and]] alcohols ~~such as~~ comprise methanol, ethanol, n-propanol, isobutyl alcohol, neopentyl alcohol and resorcinol, and ketones ~~such as~~ comprise acetone.

61. (currently amended) Process according to claim 56, wherein the organic radical scavenger is present in a concentration from 0.1% to about 10% on dry cellulosic material, ~~preferably from about 0.5 to 3%.~~

62. (previously presented) Process according to claim 39, wherein a polyelectrolyte or a surface active agent or combinations of polyelectrolytes and surface active agents are added in step c) in order to increase and facilitate mass transfer of oxygen in an oxygen delignification stage.

63. (previously presented) Process according to claim 62, wherein a polyelectrolyte is selected from cross-linked polyelectrolytes including phosphazenes, imino-substituted polyphosphazenes, polyacrylic acids, polymethacrylic acids, polyvinyl acetates, polyvinyl amines, polyvinyl pyridine, polyvinyl imidazole, and ionic salts thereof.

64. (previously presented) Process according to claim 62, wherein a surface active agent is selected from non ionic or zwitterionic compounds including poly(ethyleneoxy)/(propyleneoxy) block copolymers, fatty acids and fatty amines which have been ethoxylated; polyhydroxyl non-ionic (polyols) and a quaternized poly(propylene glycol) carboxylate or lecithin.

65. (previously presented) Process according to claim 62, wherein a high molecular weight polyethyleneglycol is added to an alkaline buffer liquor or to an oxygen delignification stage in a quantity on the order of 0.2 percent or less on the lignocellulosic material in order to reduce the viscosity of the pulping liquor.

66. (previously presented) Process according to claim 39, wherein an oxygen delignification stage is carried out in consistencies ranging from about 1 to 30%.

67. (previously presented) Process according to claim 39 wherein a lignocellulosic material treatment using oxygen compounds is carried out in a pressurized diffuser reactor.

68. (previously presented) Process according to claim 39, wherein:

in step b) anthraquinone, 2-naphtol or xylenol or derivatives thereof is added to be present during the pretreatment, and



in step c) said alkaline buffer substantially is made up of an alkali carbonate or an alkali borate or combinations thereof, and

in step f<sub>2</sub>) said concentrated spent cellulose liquor from step f<sub>1</sub>) is reacted with an oxygen containing gas in a reaction zone of a gas generator at a temperature in the range of 700-1300°C to produce a hot raw gas comprising carbon dioxide and at least one of H<sub>2</sub>, CO, H<sub>2</sub>O, and NH<sub>3</sub>, said raw gas containing entrained molten particulate matter and an aerosol of alkaline compounds, and

at least a major portion of said entrained particulate molten matter being separated from the raw gas stream and dissolved in an aqueous solution to form an alkaline solution comprising sodium or potassium compounds, and

wherein at least a portion of said alkaline solution is recycled to the oxygen delignification step c), without having been subjected to causticizing.

69. (previously presented) Process according to claim 68, wherein said hot raw gas is cooled and cleaned to produce a clean gas stream substantially free from particulate matter and alkali metal compounds.

70. (currently amended) Process according to claim 68, wherein a major portion of the entrained particulate molten matter is separated from the raw gas by gravity in a gas

diversion and smelt separation zone arranged in or adjacent to the gas generator, [[such]] said separation being effected without substantially reducing the temperature of the hot gas stream.

71. (previously presented) Process according to claim 68, wherein a gas generator is an updraft gasifier with smelt removal in a lower section of the gas generator and wherein the hot raw fuel gas is discharged from an upper section of the gas generator.

72. (previously presented) Process according to claim 68, wherein the addition of oxygen containing gas to the gas generator corresponds to 30 - 65% of stoichiometric complete combustion of the cellulose spent liquor.

73. (currently amended) Process according to claim 68, wherein the pressure in the gas generator ranges from about 0.1 MPa to 10 MPa, ~~more preferably from about 1.8 to about 4.0 MPa.~~

74. (previously presented) Process according to claim 69, wherein cellulose spent liquor is completely oxidized in the gas generator or reactor and wherein hot raw gas comprising carbon dioxide and steam, after separation of alkaline compounds, cooling and optional removal of trace contaminants and particulates, is discharged to the atmosphere.

75. (previously presented) Process according to claim 39, wherein an alkaline buffer solution comprising sodium or

potassium compounds is subjected to an oxidative treatment with an oxygen containing gas in order to activate chemical reagents, catalysts or carbohydrate protectors and/or to eliminate any traces of sulfide before the alkaline buffer solution is recycled as desired to a pretreatment, precooking or an oxygen delignification stage.

76. (currently amended) Process according to claim 39, wherein:

a portion of the lignin and other organic material in a cellulose spent liquor stream from step b) or c) or a digester circulation stream is extracted and separated from the spent liquor stream or digester circulation stream before it is discharged to concentration or combustion in order to recover substantially sulfur chemicals free lignin and other organic material,

a spent liquor stream recovered after extraction of lignin ~~an other~~ another organic material is discharged and withdrawn to be further processed in a recovery system according to steps f<sub>1</sub>) to f<sub>4</sub>) to recover inorganic chemicals, chemical reagents or chemical reagent precursors and energy values.

77. (new) A process according to claim 41, wherein the temperature during said mild prehydrolysis is maintained between 50 and 120°C under a time period of 20 to 80 min.

78. (new) Process according to claim 39, wherein lignocellulosic material is subjected to mechanical defiberization before step c), said mechanical defiberization being effected by an energy input ranging from about 50 to 300 kWh/ton of dry cellulosic material.

79. (new) Process according to claim 56, wherein an iodine compound is present in a concentration corresponding to 3-8% calculated on the lignocellulosic material.

80. (new) Process according to claim 56, wherein the organic radical scavenger is present in a concentration from about 0.5 to about 3% on dry cellulosic material.